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Notes on the Nesting Habits of the Red-bellied Bee, Andrenae rythrogaster Ash.* (Hymen.: Andrenidae).

By PHIL RAU, Kirkwood, Missouri.

In April of each year for the past six years, these solitary but gregarious bees have been nesting in my garden. They dig their burrows in the hard-packed soil of the foot path as well as in the grassy plots nearby. Their nests are easily found because a conspicuous ant-hill-like mound of fine dirt covers each tunnel. These mounds are as readily seen on the grassy plots as on the barren foot path.

The insects have been given the manuscript name of "Red-bellied bees" because of the large bright red abdomen of the female. This is in decided contrast to the small-sized and somber-colored male. Both males and females emerge from the ground within a period of two or three days, and then the mothers use the same nesting site from which they have emerged to do their own nesting. This of course makes this solitary bee a gregarious species, not so much because it is psychologically neighborly, but because it is far easier to nest where it happens to be born than to seek distant sites. There is an advantage too in keeping close to home in that impregnation is more easily accomplished. This is an advantage to insects that have short adult lives. The males fly about the nests, often rest in the grass for long periods near a mound and have occasionally been seen to enter a burrow; and often too, they have been glad to make a hasty escape, when put to rout by a busy mother.

The duration of adult life of this bee is short; at the most it is only from three to four weeks. Then the adults die off and are not seen again until the new generation appears next spring.

* Identified by Dr. Grace Sandhouse.

I said that the bees make "ant-hill-like" mounds on top of their burrows. These are conical and roughly about one and one-half inch to two inches in diameter with an opening at the side or top. The bees themselves are seldom seen when they are making these mounds. During digging operations the soil is pushed up from below with the abdomen while the bee walks backward towards the top.

The suddenness with which these mounds appear makes one suspect that the bee actually uses and enlarges the tunnel in which she has spent the winter as an immature insect. This theory is also strengthened by the fact that one seldom sees the mother bee beginning a new excavation. Of course some bees must occasionally dig new nests or the colony would not have been started in my garden.

The adult length of life which is entirely devoted by the mother to nesting is, as I have said, of about three to four weeks' duration, but coming as it does in April, the month of showers, their activities are much interrupted and curtailed. Sometimes when the rains are prolonged or severe the mortality is great, for often the soil of the mound is washed into the burrows and occasions much labor for the few mothers who are able to extricate themselves and often they are drowned when the rains enter the nests. It is surprising that in the face of short life and much hardship the species is able to maintain itself sufficiently to give forth a colony of offspring year after year.

The following table shows the dates when the bees first appeared and the approximate date when the nesting activities terminated.

Year	First seen	Activities terminated	No. of nests in colony	No. of mounds counted later
1925	April 18	May 10	April 18, 20.	.....
1926	April 19	.....	April 19, 9.	April 21, 25
1928	April 4	April 30	April 4, 3.	April 8, 50
1930	April 9	May 5	April 11, 48.	.....
1931	April 12	.....	April 12, 25.	April 15, 110
1932	April 14	May 8	April 14, 6.	April 18, 75

Thus we see that the bees made their appearance each year between April 4th and 19th, during a period of six years when the records were kept, and lived for a period of from three to

four weeks; that the number of nests reached a total of from twenty in 1925 the first year of observation to the maximum of one hundred ten in 1931.

Since the bees have little difficulty in getting food for themselves or offspring, and since no enemies in the way of parasites were seen about the nests, the fluctuation in population numbers must be wholly due to the weather conditions at the time of nesting. The biggest factor influencing population is the amount of rainfall in April. For the benefit of future compilers of the relation of insects to rain, I here append the following from my note book on the havoc played by this element.

There was much rain from April 8th to 14th, 1928, and all activity about the nests had stopped; in fact the mounds above the burrows had been beaten flat and entirely covered the openings; four days after the rain ceased (April 18th) only three mothers (out of fifty) were able to extricate thmselves and were again at work. Heavy rains again occurred on April 20, 21, and 22, and these three nests were covered solid with mud, and out of these three nests one mother survived and was able to continue her nesting work on April 23rd.

Cool days are also a hindrance to nest building. There are often several cool dreary days in April and then *Andrenae* remain comfortably indoors, but they are ambitious in propitious weather and often at 6 a. m. the mothers can be seen pushing up the soil in their burrows; they, however, do not become active among the flowers (gathering pollen) until the sun becomes warm, which, in April, is usually about 9 a. m.

Acridian Researches within Northeastern Texas (Orthoptera).

By F. B. Isely, Trinity University, Waxahachie, Texas.

Introduction.

During the past four years, 1931-34, the writer has been carrying on field and experimental studies concerning the *ecology of orthopterous insects.* Year-around field study trips—one hundred twenty-four to date in northeastern Texas—have

been made, attempting as far as possible, through critical field observations, collecting and records, to check every phase of orthopteran activity.

The present paper is a condensed summary of certain parts of my field data pertaining chiefly to the adult populations, seasonal range, and local distribution of the Acrididae (short-horned grasshoppers) studied.

Students acquainted with soil maps,[1] floral and faunal maps of northeastern Texas, know that the area here considered may, in a general way, be subdivided into four main soil divisions and consequently four chief floral and faunal divisions: (1) the east Texas timber country including the east cross timbers, (2) the blackland prairies, (3) the grand prairies, (4) the west cross timbers.

Fig. 1. Map of portion of Northeastern Texas showing number of Study Stations in the various counties and their relation to soil areas.

The blackland prairie acridian fauna, as found in Ellis and Dallas counties, has been carefully studied; the east cross timber acridians have been studied in Denton, Hill, Johnson, and Tarrant counties; the east Texas timber species have been less

thoroughly investigated in Anderson, Marion, Smith and Van-Zandt counties; only a partial check has been possible of the grand prairie short-horned grasshoppers as found in Bosque, western Denton, Hill, Johnson, and Tarrant counties; while only a beginning has been made on the field work of the west cross timbers.

However, enough data have been brought together for significant comparisons of the acridians of these several areas. Altogether twenty northeastern Texas counties have contributed to the total of the species studied, but it is well to note that the center from which the field work has radiated has been Ellis county. With a few exceptions, all of the data herein presented are based on my personal field investigations.

Historically speaking this area is of considerable interest to entomologists. Dallas County was the center of the entomological studies of Jacob Boll[2] for the period of twelve years (1869-81), while Gustaf W. Belfrage,[3] who prodigiously collected Texas insects for fifteen years (1867-82), worked especially in Bosque county. While neither of these "pioneer naturalists" published the results of their collecting, it is well known that both were all around entomologists. A number of type species of Orthoptera described by Scudder, Saussure, Stål and others were based on specimens and species first collected and studied by Boll or Belfrage, while many of the large museums and collections, both in Europe and America, have extensive series of orthopteran species sent in by them from Texas.

Dr. S. W. Geiser has pointed out, however, that as far as specific localities are concerned, Boll's *Dallas* and Belfrage's *Bosque County*, as credited and cited by entomological writers, are not always specific for these localities, as both made collecting forays into the "Piney Woods" of east Texas and other excursions west and southwest (San Antonio) from their home

[1] Carter, W. T., The Soils of Texas, Bull. 431, Tex. Agri. Exp. Sta. (1931).
[2] Geiser, S. W., The American Midland Naturalist, XI, pp. 435-452, (1929).
[3] Geiser, S. W., Southwest Review, XIV, pp. 381-98, (1929), and ENTOMOLOGICAL NEWS, XLIV, pp. 127-132, (1933).

stations respectively. Acridian literature abounds with scattered references from Texas, chiefly due to the work of Boll and Belfrage. Unfortunately most of these fragmentary references are more or less inaccessable to the average worker. Recent papers by Hebard,[4 to 7] Morse,[8] Rehn,[9] Little[10] and Isely[11] are helpful and suggestive, but do not apply directly to northeastern Texas.

The writer is deeply indebted to Mr. Morgan Hebard, Research Associate of the Department of Entomology of the Academy of Natural Sciences of Philadelphia, for helpful suggestions and difficult determinations.

On most of my study trips from one to three assistant collectors have aided me in making more complete records than would otherwise have been possible. This generous assistance was given the writer by members of his immediate family, Trinity University students and friends. My wife, Mary N. Isely, not only assisted in field work but has aided me as preparator of materials for study. In the case of a few species specific acknowledgment is given elsewhere in this paper for records obtained by other workers.

Data Concerning Species.

Some of the salient facts that have been gathered through one hundred and twenty-four year-around study trips and the rechecking of notes concerning 6287 individual specimens from my field records, representing eighty-seven species, are summarized below.

[4] Hebard, Morgan, Orthoptera of Kansas, Proc. Acad. of Nat. Sc. of Philadelphia, pp. 119-227, (1931).

[5] Hebard, Morgan, The Dermaptera and Orthoptera of Illinois, Div. Ent. Nat. Hist. Surv., Bull., XX, pp. 125-269, (1934).

[6] Hebard, Morgan, Dermaptera and Orthoptera in the Kansas State College Collection, Jour. Kansas Ent. Soc., VII, pp. 25-36, (1934).

[7] Hebard, Morgan, Notes on Orthoptera from Northwestern Minnesota, Ent. News, XLV, pp. 103-106, (1934).

[8] Morse, A. P., Further Researches of North American Acrididae, Pub. No. 68, Carnegie Inst. of Washington, (1907).

[9] Rehn, J. A. G., A Study of the Orthopterous Genus Mermiria Stal. Proc. Acad. of Nat. Sc. of Philadelphia, 1919, pp. 55-120, (1919).

[10] Little, V. A., Notes of the Acrididae of Brazos County, Texas, Ent. News, XXXVII, pp. 316-19, (1926).

[11] Isely, F. B., Field Notes on Texas Orthoptera, Ent. News, XLV, pp. 5-8, (1934).

In stating the relative numbers of individuals, I am employing terms much used by field biologists in census and population studies; in an ascending order the series here used is as follows: rare, infrequent, occasional, frequent, common, abundant, very abundant, swarming. These should serve to give other interested workers comparative information at least as far as they apply to the present study.

Seasonal range is indicated either in Roman notation I-XII, (January to December) or by naming the months. For the most part the active peak period of the annual cycle of a species is emphasized but in many cases the entire known seasonal range is given. In the case of the more populous and characteristic species "peak seasonal records," as shown by my field data, are given.

Local regional distribution is indicated by naming the counties where species have actually been taken as checked by my own field records. To a limited extent general faunal areas are indicated and in the case of a number of well-known ubiquitous species the listing of counties has been omitted.

List of Species Studied.

Acrydiinae.

Nomotettix cristatus denticulatus Morse. Bisbee, Tarran County, III, 31, '33, 2 ♀ ; Carter Lake, Marion Co., III, 31, '34, 4 ♂ , 1 ♀ .

Paratettix cucullatus cucullatus (Burm.). Common to abundant in favorable habitats—stream, pond, and lake margins—throughout the year. 107 specimens checked from Ellis, Anderson, Dallas, Harrison, Marion, Smith, Henderson, Sommervell, Tarrant, and Van Zandt Counties.

Tettigidea lateralis lateralis (Say). Common, I-XII, Ellis, Anderson, Harrison, Hill, Smith, Tarrant, and Van Zandt Counties.

T. acuta Morse.[8] Elkhart, IX, 1, '33, 1 ♀ ; Carter Lake, IV, 1, '34, 2 ♂ , 2 ♀ .

Acridinae.

Tryxalis brevicornis (Johann). Edom, Van Zandt County, VIII, 1, '33, 1 ♂ ; Tyler, Smith Co., VIII, 2, '33, 7 ♂ , 3 juv. ♀ ; Elkhart, Anderson County, IX, 1, '33, 13 ♂ , 5 ♀ . All records from east Texas timbers.

MERMIRIA PICTA (Walker). Ben Wheeler, Van Zandt Co., VIII, 2, '33, lm, 6 juvs.; same locality (Jean Wilson) VIII, 20, '33, 7 ♂, 7 ♀; Elkhart, IX, 1, '33, 9 ♂, 4 ♀. East Texas timbers.

M. NEOMEXICANA (Thos.). Locally frequent to abundant in Ellis, Dallas, Parker, and Tarrant during August and September. Earliest record, Camp Wisdom, Dallas County, VII, 16, '33, 4 ♂; latest record, Bell Branch, Ellis County, XI, 11, '31, 1 ♂, 1 ♀.

M. BIVITTATA (Serville). With the aid of Rehn's key[9] the males are easily separated from *M.m. maculipennis* with which species *M. bivittata* was always closely associated wherever it was found. Thus far this species has not been secured in my field studies in the grand prairies or in the west cross timbers; VI-VIII; Ellis, Dallas, Johnson Counties.

M. MACULIPENNIS MACULIPENNIS Bruner. This species is the outstanding virgin prairie acridian during July and August in both the black prairies and the grand prairies. While very abundant in the sandy *Andropogon* sp. stretches of the east cross timbers, I did not take *maculipennis* in four days field work in southeastern Van Zandt, Smith, and Anderson Counties. 313 specimens have been checked in my field studies. Earliest adult record is VI, 16, peak of abundance through July, swarming in optimum localities; VI-X; Ellis, Hill, Dallas, Johnson, Palo Pinto, Parker, Tarrant Counties.

MESOCHLOA ABORTIVA Bruner. An active fall and winter species, common on warm days X-V, Ellis, Bosque, Dallas and Tarrant Counties. Third instar juveniles taken in Palo Pinto and Parker Counties, VIII, 1-2, '34.

ACROLOPHITUS VARIEGATUS (Thos.). Common in optimum localities in late May and June, only occasional specimens during July; Ellis, Dallas, Johnson, Denton, Tarrant and Wise Counties.

SYRBULA ADMIRABILIS Uhler. Reaches peak of abundance in late August, although many juveniles may be taken in September. While never swarming in the numbers observed for *M. maculipennis* and certain of the Melanopli, *S. admirabilis* is by far the most populous and widely distributed Acridian in this area from middle August into October. Taken in every locality where collecting has been done during these months and frequently outnumbering in individuals all other species of the Acrididae combined. Field notes: "McWhorter's ranch, May Pearl, Ellis County, IX, 16, '32, in upland, Houston stony clay, weedy pasture (chiefly broom weeds, *Amphiachyrus*).

Four collectors working for one hour in late afternoon, found 34 species of Orthoptera among 131 specimens; 90 individuals of this lot represented 19 species of the Acrididae; of the 90, 49, or over half, were *S. admirabilis*, 19 ♂, 25 ♀, 5 juvs.; other leading associates in this habitat at this date were *M. m. mexicanus*, 8 ♂, 4 ♀; *M. m. scudderi*, 6 ♂, 5 ♀; *C. o. olivaceae*, 2 ♂, 5 ♀." Taken in Ellis, Anderson, Bosque, Dallas, Denton (Dr. B. B. Harris), Henderson, Hill, Johnson, Freestone, Kaufman, Palo Pinto, Parker, Tarrant and Van Zandt Counties.

S. FUSCOVITTATA (Thos.). This species has been rare with the exception of one station, Camp Wisdom, Dallas County, IX, 18, '31, 15 ♂, 15 ♀; also taken in Ellis, Bosque and Parker Counties.

OPEIA OBSCURA (Thos.). An occasional to frequent midsummer and fall species among short mesquite grasses; Ellis, Johnson, Palo Pinto, Parker and Tarrant Counties.

AMPHITORNUS COLORADUS (Thos.). Only 8 ♂, 17 ♀, 1 juv., and these chiefly from the grand prairie stations; VI-VIII: Ellis, Dallas, Palo Pinto, Parker, Tarrant and Wise Counties.

AMBLYTROPIDA OCCIDENTALIS (Sauss.). A late fall and winter species. Locally occasional to common in east cross timber and east timber open woods; X-V; Anderson, Harrison, Johnson, Marion and Tarrant Counties; peak collection at Mansfield, Tarrant County, IV, 21, '34, 6 ♂, 14 ♀.

ERITETTIX SIMPLEX (Sc.). This comparatively infrequent species proved to be common in an old pasture with a heavy growth of dead prairie grass (*Andropogon* sp.), White Rock Lake area, Dallas County. Field notes: "Four collectors working over an hour secured IV, 28, '34, 18 ♂, 34 ♀." Infrequent juveniles have been taken in March, June and November; Ellis, Dallas and Tarrant Counties.

PHLIBOSTROMA QUADRIMACULATUM (Thos.). Infrequent to occasional at grand prairie stations; VI-VIII; Ellis, Johnson, Palo Pinto, Parker and Tarrant Counties.

ORPHULELLA PELIDNA (Burm.). Locally common in open, sandy, oak woods; VI-IX; Anderson, Dallas, Freestone, Johnson, Kaufman, Tarrant and Van Zandt Counties.

ORPHULELLA SPECIOSA (Sc.). An abundant late summer and fall acridian found especially in short bermuda grass pastures. Taken at prairies as well as at east cross timber and east timber stations; V-XII; Ellis, Dallas, Freestone, Navarro, Smith, Tarrant and Van Zandt Counties.

(To be continued.)

An Analysis of the Cicindela purpurea Group (Coleop.: Cicindelidae).

By E. Graywood Smyth, Entomologist, W. R. Grace & Co. Sugar Estates, Trujillo, Peru.

(Continued from page 19.)

(10) *C. transversa* Leng. Mr. Leng lists this as a variety of *splendida,* while Dr. Horn considers it a "minor form" (whatever that may be in American terminology) of *splendida.* Nicolay and Weiss place it, correctly, among the varieties of *limbalis.* All of this confusion arises, plainly, from the mistaken attitude in considering *splendida* as a valid species, when in fact it is a geographic race of *limbalis,* the varieties *transversa* and *cyanocephala* connecting the two, the one in color, the other in maculation. This statement should not be taken as contradictory to the writer's recent quotation (8, p. 202) from an earlier writing, where he spoke of the interbreeding of this variety with *splendida* as "thus establishing *splendida* as a variety of *transversa,* and so of *purpurea.*" At the time that was written, in 1907, *limbalis* and its varieties were considered as all belonging to the species *purpurea.*

(11) *C. cyanocephala* Varas. (= *C. amoena* Lec. of Leng). Here again we have complete confusion, from the same cause mentioned above (i.e., considering *splendida* as a species). Leng correctly considers this a variety of *limbalis;* Horn, a "larger race" of *purpurea;* and the authors of the Synopsis, a variety of *splendida.*

(12) *C. splendida* Hentz. Leng in his catalogue, and Nicolay and Weiss in their Synopsis, consider this a valid species. Western collectors who know its phylogeny and habitat cannot figure this out. Horn places it as a "larger race" of *purpurea,* on the mistaken assumption, it would appear, that *limbalis* and *purpurea* are one species. The writer cannot consider *splendida* as other than a variety (geographic race) of *limbalis,* and has no fear that Cicindelists of the Middle West will not uphold him in this view.

(13) *C. ludoviciana* Leng. Leng, Horn, and Nicolay and Weiss, all agree in calling this a variety (or "lesser form"—Horn) of *splendida*. In the writer's eyes it is a local variety, or race, of *limbalis*.

(14) *C. denverensis* Casey. All place this as a variety, or form, of *splendida;* which makes it of course, a variety of *limbalis*. Distance of separation from the stem species has no bearing on the situation, so long as there are connecting links. And there are (in *splendida* and *transversa*).

(15) *C. plattensis* Smyth (= *C. conquisita* Casey fide Nicolay). All authorities place *conquisita* as a synonym of *denverensis*, preferring not to consider as a distinctive character the differences of maculation. This essentially ignores Casey's description of the maculation of *denverensis*. And in the Nicolay and Weiss "key" to the group, this variety would run down to *pugetana* or *decemnotata*, with neither of which it bears any close relationship. If, in proposing the name *plattensis* (8, p. 202), the writer has without intention made a synonym, as Mr. Nicolay asserts (4, p. 154), it has at least accomplished the result desired, namely, the recognition by name of a western, fully maculate, all-green (or blue and green) geographic race of *limbalis* paralleling the maculation of *limbalis* and *cyanocephala*. Such specimens have heretofore rested in all collections without name, or improperly under *denverensis*. Since Colonel Casey, as pointed out by Dr. Horn (2, p. 74), had the custom of describing "localities" and "individuals," and in many cases sports and Mendelian forms, without immediate access to his types for purposes of comparison it was not possible to assign a name to this variety in other manner.

(16) *C. propinqua* Knaus. Horn wrongly interpreted this as a variety of *tranquebarica* Herb., but Leng and Mutchler in their Supplement to the Leng Catalogue of Caleoptera, 1927, assign it a number as a variety of *splendida*. Nicolay and Weiss so consider it also. This makes of it, logically, a geographic race of *limbalis*.

(17) *C. decemnotata* Say. Mr. Leng gives this, quite correctly, specific standing, as do also Nicolay and Weiss. Doctor Horn considers it a "larger race" of *purpurea*, on a par with *lauta, splendida, cyanocephala*, etc. He makes no discrimination in the comparative values or inter-relationships of these.

(18) *C. pugetana* Casey. Considered by Leng a variety of *purpurea*, and by Horn a "larger race" of *purpurea*. Nicolay and Weiss differ with both, placing it as a variety of *splendida*, to which, in our opinion, it bears no close relationship. This and the preceding species may be readily distinguished from all varieties of *purpurea* and *limbalis* by the more polished surface texture, and by other anatomical differences.

To summarize: of the above 18 species and varieties, the authors of the Synopsis agree with our two outstanding authorities, Charles W. Leng and Walther Horn, in only four cases (*purpurea, ludoviciana, denverensis, conquisita*); agree with only one of them (Leng) in eight cases (*auduboni, nigerrima, cimarrona, limbalis, spreta, splendida, propinqua, decemnotata*); and disagree with both of them in six cases (*auguralis, lauta, mirabilis, transversa, cyanocephala, pugetana*). Plainly, where the two older authorities are not themselves in agreement, the authors of the Synopsis could not well agree with both of them. But it is conspicuous that they disagree with both oftener than they agree with both. This, naturally, does not convince us that there is very little that they have changed.

Before closing, the writer would call attention to a few discrepancies in Mr. Nicolay's "answer" to his criticisms of the Synopsis.

1. The writer made no comparison of the *purpurea* group with the Megacephalini, as stated by Nicolay (4, p. 128), but characterized it as "the most difficult group in the genus Cicindela" (8, p. 197). He has not changed in that opinion.

2. Neither did he take issue with the authors of the Synopsis in their use of color and maculation in a key to separate varieties, for he knows as well as they that "it cannot be done" on the basis of structure, unless perhaps by the genitalia. What

he objected to, and so stated clearly, was the exclusive use of color and maculation in a key to determine "species" (viz., *splendida; cimarrona*), and to the hopeless mixing up of the species and varieties in a key, using color as sole criterion, instead of arranging them according to their genetic relationships, which would vastly simplify the matter.

3. He made no objection to their "recognizing only species and varieties;" he would certainly do the same. What he took exception to was the "elevating subspecies to specific rank," because, the term subspecies the authors use themselves as equivalent to Doctor Horn's term "larger races," and there can be no doubt that these races, by American usage, are varieties (in all cases except *limbalis* and *decemnotata*).

4. When the writer stated that "those acquainted with the *purpurea* group have decided years ago that *cimarrona* is not entitled to specific standing" he referred very naturally to those who have collected and know intimately the habits of the western varieties, or who have first hand information from others who had collected them. He needs make no apology to Mr. Leng on this score. How can one who knows only museum specimens pass fair judgment on the inter-relationship of varieties? To use Mr. Nicolay's expression: "It cannot be done."

5. The writer, in quoting Doctor Lantz (8, p. 200) on the varieties of *purpurea*, did so to bring out only one point: that Lantz, who had also collected *cimarrona*, considered it a variety of *purpurea*. The writer made no mention of, and places no importance whatever upon, the size, shape, or degree of inclination of the median band in *Cicindela*, except, in rare cases, in so far as those features are relatively constant (as in *decemnotata* Say and *eureka* Fall). So this is *not* "one of the few things that we agree on" (4, p. 131). In *cimarrona* and *auguralis* the length and inclination of the median band is anything but constant; and Nicolay himself states that (4, p. 130) in the paratype specimens of *auguralis* the median band is "slightly more oblique than in typical *limbalis*." One who has not material at hand might consult Shelford (6, pl. 25, figs. a to d) for some idea of the variability in the markings of

cimarrona and *auguralis* (which Shelford miscalled *spreta*). Shelford plainly marks these "level ground inhabitants," which proves that they are *not* varieties of *limbalis*, but rather, of *purpurea*.

6. Mr. Nicolay speaks of "this so-called species *sedalia*," which is very carelessly (if not intentionally) misquoting (4, p. 130). The writer distinctly named it as a variety of *limbalis* (8, p. 200), and mentioned no "connection between this form and *cimarrona*." Nor is there indeed any connection, except that both occur in Colorado and both belong to the *purpurea* group, their habits being entirely different. Nor is it significant that Doctor Horn has not assigned a name to the variety. If Mr. Nicolay can fit "specimens from Colorado in the Horn collection . . . nicely in either *limbalis*, *splendida* or variety *cyanocephala*, and *cimarrona*," he may consider it clever. But who said that any such specimens were *sedalia?* The variety *sedalia* is at once distinguishable from all other varieties of *limbalis* by broad markings, dilated marginally and often confluent on the margin as in *latesignata* Lec. (no other variety of *limbalis* develops a marginal band), by usually entire humeral and apical lunules that are quite persistent and seldom broken into dots (other varieties of *limbalis* seldom if ever develop entire humeral lunule, and never in a whole series of specimens), and color, usually red, suggestive of the more eastern forms, that does not occur at lower altitudes on the adjoining plains, except as a rare mutation. That transition forms occur between *sedalia* and the neighboring named varieties of *limbalis* there is abundant evidence; but as much may be said of any other named variety of *limbalis* that has been recognized in our catalogues. Like *ludoviciana*, *sedalia* is a very local and somewhat sporadic race, but none the less well defined in its divergence from other known varieties.

7. One who owns the extensive Casey literature, who has lived some years in Washington and spent hours over the National Collection of beetles in company with our late, kindly and erudite Doctor Schwarz, and who was there when Mr. Buchanan unboxed the Casey types and transferred them to

cabinet, can perhaps afford to pass over a critic's suggestion that he evidently "never looked in a Casey box."

8. Mr. Nicolay has the right to pride himself on his familiarity with certain eastern collections which he enumerates, but should not consider that he monopolizes a knowledge of those collections, for that can be challenged. If he will examine again the Cicindela collection of the American Museum of Natural History in his own Manhattan, he will find there a nice series of *Cicindela mirabilis* Casey, properly labeled, all with cupreous head and thorax, from Dutch Flat, Placer County, California (March)—specimens identical with those that he claims to have discovered, tardily (4, p. 153), in the collection of Mr. Wood. We believe he mistakes also in presuming that temporary residence in Peru, "several thousand miles away from collections and literature," predisposes to senility.

References

(1) Horn, Walther. 1903. Letters of a Traveling Entomologist. Published by Warren Knaus, Press of Democrat-Opinion, McPherson, Kans., pp. 44.

(2) Id. 1930. Notes on the races of Omus californicus and a list of the Cicindelidae of America North of Mexico. Trans. Amer. Ent. Soc., Phila., LVI, pp. 73-86.

(3) Leng, Charles W. 1920. Catalogue of the Coleoptera of America North of Mexico. John D. Sherman, Jr., Publ. Mount Vernon, N. Y., pp. 470.

(4) Nicolay, Alan S. 1934. An answer to E. Graywood Smyth on "Synopsis of Cicindelidae." Entomological News, Phila., XLV, 6, pp. 127-131, and 7, pp. 153-155.

(5) Nicolay, Alan S., and Weiss, Harry B. 1932. Synopsis of the Cicindelidae. General introduction, bibliography and Purpurea Group. Jour. N. Y. Ent. Soc., N. Y., XL, 3, pp. 341-355.

(6) Shelford, Victor E. 1917. Color and color-pattern mechanism of Tiger Beetles. Illinois Biological Monographs (Univ. of Ill., Publ.), Urbana, III, 4, pp. 134, 32 pls.

(7) Smyth, E. G. 1905. Notes on collecting Cicindelidae. Trans. Kans. Acad. Sci., Topeka, XIX, pp. 425-432.

(8) Id. 1933. On the Nicolay and Weiss synopsis of the Cicindelidae. Entomological News, Phila., XLIV, 8, pp. 197-204.

New Histeridae from the Nests of Ants of the Genus Atta in Mexico (Coleoptera).

By Howard E. Hinton, Cambridge, England.

While determining a collection of Histeridae taken from the nests of *Atta sexdens* L. and *A. fervens* Say by the writer and others in Mexico at various times during the past few years, four new species have come to light. The Histerids described below were not taken in the actual nests of the leaf-cutting ants, but they were taken in accumulations of waste material which are deposited by the ants near the openings of the nests. Through the kindness of Dr. W. M. Mann, the *Atta* from the District of Temascaltepec was determined as *A. sexdens* L. The writer determined the *Atta* from Cuernavaca as *A. fervens* Say.

Saprinus pusio, new species.

Broadly oval, rather convex, black with a slight aeneous lustre, shining; antennae, mouth-parts and legs rufo-piceous.

Head without impressed lines, finely, transversely strigose anteriorly, extremely finely, sparsely punctate basally.

Prothorax twice as wide as long, apical margin very finely but densely ciliate, apical and lateral marginal lines fine; sides arcuate, converging moderately to apex; base evenly arcuate; surface finely, evenly, moderately sparsely punctate, extreme base with moderately coarse, closely placed punctures.

Elytra twice as long as prothorax, base nearly impunctate, posteriorly finely punctate, punctures becoming gradually denser apically and being moderately dense in apical one-third, extreme apex impunctate; striae somewhat feebly, crenately punctate and extending only to about basal one-tenth and slightly unequally to apical one-third, two joined in a broad arch to sutural which gradually converges nearly to suture near apex; humeral at base scarcely visible, short, diagonal, more longitudinal and distinctly impressed for a short distance in apical one-half; scutellum minute, triangular. Propygidium nearly impunctate basally, moderately finely and densely punctate apically; pygidium moderately finely, densely punctate, with the punctures becoming finer and sparser on disk.

Prosternal striae sinuately diverging anteriorly to end in a deep pit before which they are contingent with carinae above antennal cavities; mesosternum broadly, feebly emarginate in front, moderately densely, coarsely punctate, marginal line

feebly, broadly sinuate; metasternum coarsely, sparsely punctate. Length, 1.6 mm.; breadth, 1 mm.

Type: Deposited in the collection of the writer. Collected at Tejupilco, District of Temascaltepec, MEXICO, alt. 3960 ft., in July, 1933 (H. E. Hinton, R. L. Usinger).

It was taken from the deposits of *Atta sexdens* L. It is difficult to relate *Saprinus pusio* to any of the known species, for it is quite distinct. It is the smallest species recorded from this region. Its small size, head without impressed lines, pronotum finely and evenly punctate except at extreme base, coarsely, moderately densely punctate mesosternum, and coarsely, moderately sparsely punctate metasternum should make this species an easily recognizable one.

Saprinus formicus new species.

Broadly oval, convex, black, strongly shining; antennal club fuscous, mouth-parts and legs piceous.

Head with distinct supra-orbital striae extending to base of clypeus, very finely, moderately densely punctate, anteriorly slightly strigose; scape of antennae with a few long, erect, testaceous hairs.

Prothorax one-half wider than long, feebly ciliate along apex, apical marginal line fine, lateral fine apically, more coarse basally; sides converging feebly to apex, nearly straight, strongly rounding near apex; surface finely, moderately densely punctate basally, elsewhere extremely finely, sparsely punctate.

Elytra finely, sparsely punctate basally, with the punctures becoming coarser and denser apically, apical two-thirds coarsely, moderately densely punctate; striae fine, finely, not closely punctate, outer humeral well impressed and extending from basal one-fourth to apical one-fourth, humeral scarcely impressed, short, diagonal; striae five to two slightly curved at base, fifth extending to apical one-third, fourth to second progressively shorter, second extending only to apical one-half and joined in an arch at base to sutural which extends to apical one-fifth and does not converge but is parallel to suture; scutellum small, equilateral; Pygidium coarsely, moderately densely, evenly punctate.

Prosternal striae parallel, slightly sinuate at middle, extending nearly to apex and not ending in fovea; prosternum slightly convex between striae; carinae above antennal cavities straight

and parallel with prosternal striae; mesosternum very coarsely, densely punctate; metasternum finely, sparsely punctate except caudally where it is coarsely, densely punctate with shallow, oblong-oval punctures; extreme base of first ventral segment punctate as adjacent area of metasternum, apex with a row of fine, closely placed punctures. Length, 3.8 mm.; breadth, 2.5 mm.

Type: Deposited in the collection of the writer. Collected at Tejupilco, District of Temascaltepec, MEXICO, alt. 3960 ft., June, 1933 (H. E. Hinton, R. L. Usinger).

Paratypes: Three. Same data as above.

All specimens were collected in the deposits of *Atta sexdens* L. This is a very distinct species, and it can not be closely related to any of the previously described species of *Saprinus* from North America. Its most distinctive character is found in the punctation of the pronotum which is anteriorly and at sides only extremely finely and sparsely punctate without coarser punctures. In the few species of *Saprinus* in which the pronotum is, except at extreme base, extremely finely and sparsely punctate, there are nearly always a few coarser punctures apically near the sides.

Epierus pubifrons new species.

♂ : Oblong oval, convex, dark rufo-piceous, strongly shining; antennae, mouth-parts and legs paler, antennal club somewhat testaceous.

Head without raised or impressed lines; front slightly concave, clypeus anteriorly with a semicircular area which is densely clothed with short, stiff, testaceous hairs; surface very finely, moderately densely punctate, with the punctures somewhat sparser basally.

Prothorax one-third wider than long, apical and lateral marginal lines moderately fine; sides arcuate, converging moderately to apex; base arcuate, more strongly arcuate at middle; surface moderately finely, densely, evenly punctate and also with extremely fine punctures sparsely intermixed, base with a row of coarser, closely placed punctures and an oval impression in front of scutellum.

Elytra more than twice as long as prothorax, finely, moderately sparsely punctate throughout; striae moderate, finer nearer suture, moderately closely, crenately punctate, all ex-

tending from near base to near apex with exception of sutural which does not extend so near to base; humeral (seventh) absent but humerus with a feeble, diagonal impression extending only in basal one-fourth; scutellum small, equilateral. Propygidium one-third as long as pygidium, moderately densely punctate with moderately fine and extremely fine punctures intermixed; pygidium moderately finely, moderately densely punctate and also with a few microscopical punctures sparsely intermixed.

Prosternal striae moderately widely separated, diverging slightly caudally, parallel anteriorly, not attaining lobe; mesosternum microscopically punctate, marginal striae in front present only at sides of emargination; metasternum moderately densely, extremely finely punctate, much more coarsely punctate caudally; first ventral segment finely, moderately densely punctate, more coarsely punctate at sides. Length, 2 mm.; breadth, 1.1 mm.

♀: Front not concave; clypeus anteriorly without hairs; slightly more coarsely punctate throughout.

Type: Male in the collection of Mr. C. A. Ballou, Jr. Collected at Cuernavaca, Estado de Morelos, MEXICO, June, 1934. (H. E. Hinton.)

Paratypes: One female with same data as above. Three males and three females collected at Tejupilco, District of Temascaltepec, Mexico, alt. 3960 ft., June, 1933 (H. E. Hinton, R. L. Usinger).

The male may readily be separated from all other North American species of the genus by the pubescence on the anterior portion of the clypeus. The female resembles *Epierus intermedius* Mars., but is about one-third smaller, the head and pronotum are more densely and more coarsely punctate, and the sutural and second striae are not abbreviated. Specimens from Cuernavaca and Tejupilco were collected in the deposits of *A. sexdens* and *A. fervens* respectively.

Epierus singulistrius new species.

Oblong oval, convex, dark rufo-piceous, strongly shining; antennal club testaceous; antennae, mouth-parts, pronotum, pygidia, and legs paler rufo-piceous.

Head with supra-orbital striae curved anteriorly and extending a very short distance across front; surface extremely finely, moderately sparsely punctate.

Prothorax nearly twice as wide as long, apical and lateral marginal lines moderately fine; sides nearly straight, converging to apex; base evenly arcuate; surface very finely moderately sparsely punctate, with a few coarser punctures near sides, base with a row of closely placed punctures on middle one-third and with an oblong impression in front of scutellum.

Elytra half again as long as prothorax, extremely finely, moderately sparsely punctate throughout; striae moderate, feebly but closely, crenately punctate and with exception of second all extending from near base to near apex, second present only in apical one-half, sutural diverging from suture towards base and shortly curved outwardly near base; humeral absent, humerus with a short, diagonal, feeble impression in apical one-third, outer humeral well impressed, present in apical two-thirds; scutellum nearly equilateral. Propygidium two-thirds as long as pygidium, moderately coarsely and sparsely punctate, with extremely fine punctures intermixed; pygidium very finely, moderately densely punctate and with a few coarser punctures basally.

Prosternum between striae narrow, convex; striae diverging caudally, parallel anteriorly, not quite attaining lobe; carinae in front of anterior coxal cavities short, nearly parallel with prosternal striae; mesosternum slightly elevated above metasternum and limited posteriorly by a strongly sinuate line, anteriorly feebly, very broadly, arcuately emarginate, marginal stria complete, feebly sinuate in front, surface extremely finely, moderately sparsely punctate. Length, 2 mm.; breadth, 1.2 mm.

Type: Female in the collection of Mr. C. A. Ballou, Jr. Collected at Tejupilco, District of Temascaltepec, Mexico, June, 1933, alt. 3960 ft., (H. E. Hinton, R. L. Usinger).

Paratypes: Two females and five males. Same data as above.

All specimens were collected in the deposits of *Atta sexdens* L. This species may be separated from all others by the complete sutural striae and very short second striae. The males have the meso-metasternum concave and more strongly punctate. The mesosternum is often in the males not so distinctly elevated above the metasternum, as it is in the females, but this last character is very variable.

ENTOMOLOGICAL NEWS

PHILADELPHIA, PA., FEBRUARY, 1935.

ENTOMOLOGY AT THE CONVOCATION WEEK MEETINGS, DECEMBER 27, 1934, TO JANUARY 2, 1935.

Our annual summary of the entomological items of the programs of the American Association for the Advancement of Science and Associated Societies, held at Pittsburgh, Pennsylvania, follows:

The number of papers bearing on insects, including those in symposia and non-duplicating demonstrations, were:

*Entomological Society of America (including a joint session with the Ecological Society of America)	52
American Association of Economic Entomologists	127
American Society of Zoologists	21
American Society of Parasitologists	6
*American Phytopathological Society	4
Genetics Society of America	20
*Potato Association of America	2
Wilson Ornithological Club	1
American Society of Naturalists	1
Committee on Hydrobiology and Aquiculture, National Research Council	2
Section N, Medical Sciences, A. A. A. S.	2
American Nature Study Society	1
Total	239

These papers were distributed in subject as follows:

i		Behavior	1
General Entomology	2	*Geographical Distribution	6
*Collecting and Rearing Methods	7	Genetics	12
Entomological Instruction	1	*Evolution	4
Entomological Museums	3	*Taxonomy	6
*Cytology	13	Parasites and Diseases of Insects	8
*Embryology and Life History	11	*General Economic Entomology	19
Anatomy and Morphology	3	Insecticides	28
*Physiology	37	Apiculture	12
*Ecology	12	*Insects Affecting Man	12

* do. Other Animals 6
do. Cereals and Field Crops 16
do. Truck Crops 13
* do. Ornamental & Greenhouse Plants 6
do. Fruits and Fruit Trees 14
do. Forest and Shade Trees 9

ii

*Acarina 4
Orthoptera 16
Dermaptera 1
Isoptera 1
Ephemerida 1
Odonata 1
Homoptera 16
*Heteroptera 5
Thysanoptera 1
Neuroptera 1
Coleoptera (excluding Jappanese Beetle).....18
* Japanese Beetle 2
Hymenoptera (excluding Honey Bee and *Habrobracon*) 11
Honey Bee 9
Habrobracon 5
*Lepidoptera (excluding Codling Moth, Oriental Fruit Moth and Corn Borers) 19
* Codling Moth 13
Oriental Fruit Moth... 2
Corn Borers 1
*Diptera (excluding *Drosophila*) 26
Drosophila 13

Many of these figures are duplications, both between sections i and ii and also within each section.

The total number of papers at Cleveland, 1930, was 180, at New Orleans, 1931, 185, at Atlantic City, 1932, 212, at Boston and Cambridge, 1933, 227. Increases in numbers of papers over the corresponding figures for 1933 are starred (*).

Both entomological societies met December 27 to 29, in different rooms, mostly on the same floor, of the William Penn Hotel. This contributed to frequent visiting from one society to the other. Meetings of the other societies in the above list were held mostly in or near the University of Pittsburgh, at such a distance as to prevent the easy attendance of entomologists chiefly interested in their own associations.

The Entomological Society of America was presided over by Prof. C. L. Metcalf, University of Illinois, and Prof. H. B. Hungerford, University of Kansas, continued his ministrations as secretary. The annual symposium, on Improved Technique in the Study of Insects, participated in by fifteen speakers, brought out many useful suggestions on collecting equipment and field methods, museum technique, modern taxonomic methods, rearing insects of various habitats, ecological, behavioristic, physiological, toxicological and morphological studies and those of insect-borne diseases. It is to be hoped that all these will be published and thus rendered available to all interested persons.

Dr. E. F. Phillips, Cornell University, and Mr. A. I. Bourne, Massachusetts State College, were president and secretary, respectively, of the American Association of Economic Entomologists. The President's address dealt with the Increasing Complexities of Economic Entomology. Instead of the usual Entomologists' dinner, a smoker was held on Friday evening, December 28, immediately following the annual public address of the Entomological Society. This address, by Dr. C. H. Kennedy, Ohio State University, was a keen analysis of the Family and the Society, both human and insectan. In the afternoon of the same day, Dr. Kennedy was elected president of the Entomological Society for 1935, a honor which he has well earned by his editorial conduct of the *Annals*.

The Courtship and Mating of the Wasp, Monobia quadridens (Hymen.: Vespidae).

The wasp, *Monobia quadridens* makes mud partitions in the old burrows of the carpenter bee, *Xylocopa virginica,* and uses the rooms for her own progeny provisioning them with caterpillars. The adult wasps make their appearance in this region about the middle of May of each year and live until about the middle of September. The males appear at the same time with the female and, unlike certain other Aculeate Hymenoptera, do not die shortly after they are born.

The males go through certain courtship or sun dances in front of the boards containing the nesting females. The details of this behavior is as follows: Every morning for about a week, beginning May 17th, 1932, a dozen or more male wasps were flying with fantastic motion about these boards. This started with a few individuals about 7 a. m. and by 9 o'clock the number in this flight would increase to about 18, and by noon it would be reduced to a very few individuals, but by 2 o'clock the flight had completely ceased. This same behavior went on for about three weeks but mating did not occur. Sometimes a male would follow a caterpillar-laden mother into the burrow but was usually driven out; sometimes when repulsed he would quietly wait in the doorway and when an opportunity offered, would again attempt to mate. In this case a rough and tumble battle followed, with the interlocked pair dropping to the ground.

By June 12th, only a few were to be seen daily in the dance, and by June 15th, (a month after the commencement of this behavior) the dance was completely over, although occasionally after this date a pouncing male was seen attempting to mate with an industrious mother.

In spite of the daily courtship dances, actual mating escaped

my notice, if it occurred at all. However, later in the season, long after the dances had stopped (week of August 10th) several pairs were seen in actual copula. In every case the female was at rest on the board containing the borrows or on the vegetation nearby, while the male hung free in the air head downward while attached to the female. In one case the female made short flights from bush to bush with the male dangling free in the air beneath her. The maximum time in which any of the half dozen pairs observed remained in copula was about thirty minutes.

PHIL RAU, Kirkwood, Missouri.

Ovoviviparity in Colias? (Lepid.: Pieridae).

Recently when making a preparation of the genitalia of a female *Colias hecla* Lefebre from Fort Churchill, Manitoba, I was greatly surprised to find a well-developed, apparently first instar larva in the oviduct. There was no trace of a chorion accompanying the larva, nor could any such structures be seen further up the oviduct.

Kusnezov (Horae Ent. Soc. Russ. 39: 634-651. 1909-10) recorded the same phenomenon as occurring in occasional specimens of a large number of species of Palaearctic *Colias* and Euchloini. He was likewise unable to find a trace of chorion in any of the numerous specimens containing larvae that he examined.

Such data are of course far from constituting proof of the occurrence of ovoviviparity in these butterflies, but are highly suggestive. The phenomenon is known to occur in the Microlepidoptera (*Tinea vivipara* of New South Wales) but has not been recorded from the higher moths or the butterflies. If it should occur in these higher forms it might well be expected in *Colias* or in similar Arctic-inhabiting groups which, handicapped by the very short growing season of the far North or of Alpine regions, would be benefited greatly. The habit would probably occur at first in only a small percentage of the specimens of a species and, if definitely beneficial, become more and more common. Moreover it would thus be more likely to be retained in the more northern or Alpine parts of a species' range, where very few specimens are collected.

Collectors of Arctic butterflies should therefore keep this possibility in mind when in the field. Females seen fluttering around known or potential specimens of a food plant should not be collected immediately but observed with care; any eggs or larvae deposited should then be collected immediately and preserved. Moreover the preservation of some *fresh*, not dried, females for cytological examination, using a fixative such as Bouin's Fluid, would be extremely useful.

ALEXANDER B. KLOTS, College of the City of New York.

Entomological Literature

COMPILED BY LAURA S. MACKEY UNDER THE SUPERVISION OF E. T. CRESSON, JR.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species will be recorded.

The **figures within brackets** [ ] refer to the journal in which the paper appeared, as numbered in the list of Periodicals and Serials published in our January and June issues. This list may be secured from the publisher of ENTOMOLOGICAL NEWS for 10c. The number of, or annual **volume**, and in some cases the part, heft, &c. the latter **within** ( ) follows; then the pagination follows the **colon** :

All continued papers, with few exceptions, are recorded only at their first installments.

(*) Papers containing new forms or names not so stated in titles, have an * within parentheses thus (*) following the pagination of reference to paper.

(S) Papers pertaining exclusively to neotropical species, and not so indicated in the title, have the symbol (S) at the end of the title of the paper.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

Note. Titles of papers containing new forms or new names will be indicated by an asterisk within parentheses at end of reference, (*).

Papers published in the Entomological News are not listed.

GENERAL.—Dowden, P. B.—Recently introduced parasites of three important forest insects. [7] 27: 599-603. **Engelhardt, G. P.**—Random notes from a home garden. [19] 29: 196-197. **Fletcher, T. B.**—Names, mere names. [21] 46: 113-116. **Lack, D.**—Some insects from the Scoresby Sound Region, East Greenland, with an account of the fauna of a Nunatak. [75] 14: 599-606. **Mani, M. S.**—Dispersal of gall mites by gall midges. [Cur. Science] 3: 208. **Oudemans, J. T.**—In memoriam door J. C. H. de Meijere [101] 77. 167-174, ill. **Smith, R. C.**—Hallucinations of insect infestation causing annoyance to man. [19] 29: 208-212. **de la Torre-Bueno, J. R.**—Methods and technique. [19] 29: 213-214. **Warnecke, G.**—Grundsätzliches zur methodik zoogeographischer untersuchungen in der Entomologie. [18] 28: 437-441, cont.

ANATOMY, PHYSIOLOGY, ETC.—Beal, J. A.—Relation of air and bark temperatures of infested ponderosa pines during subzero weather. [12] 27: 1132-1139. **Blumenthal, H.**—Untersuchungen ueber ein tarsales sinesorgan bei spinnen. [34] 108: 263-266, ill. **Bugnion, E.**—La larve du grand lampyre algerien (Pelania mauritanica) Biologie, anatomie, physiologie. [Rev. Suisse Zool.] 41: 699-734, ill. **Butt, F. H.**—Embryology of Sciara (Sciaridae). [7] 27: 565-579, ill. **Docters van Leeuwen, W. M.**—Die sexuelle generation von Andricus solitarius. [101] 77: 232-234. **Fulton, B. B.**—Rhythm, synchronism, and alternation in the

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